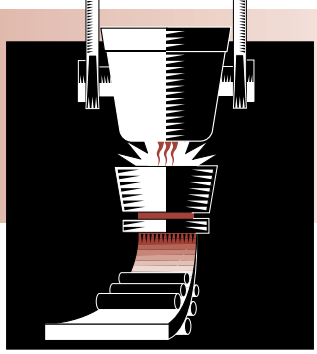
STEEL

Project Fact Sheet



Improved Surface Quality of Exposed Automotive Sheet Steels

Benefits

- Ability to evaluate surface imperfections quantitatively
- Improved inspection criteria to make correct decisions on coil-disposition leading to fewer internal rejections
- Availability of quantitative information to aid in the development of new paint systems with possible environmental benefits
- Energy benefits are anticipated from improved application rates and reduced rejections

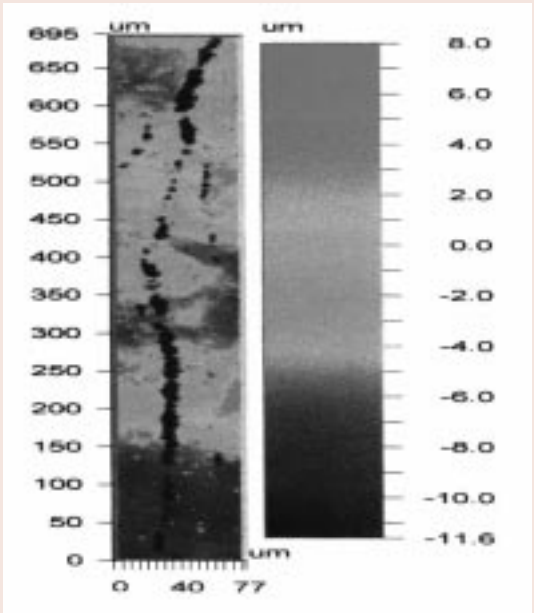
Applications

The results of this program, when applied for inspection and acceptance criteria, can provide better coil-disposition decisions. The most significant application will be for painted automotive steel sheets. A clear definition of the surface topography characteristics that lead to satisfactory painting performance will be of great value to the steel and automotive industries.

Improved surface quality results in improved cost, productivity, and competitiveness

Surface quality in exposed applications (i.e. visible to the final consumer) represents an enormous economic, technical, and operating issue for sheet steel producers. Significant quantities of material are sometimes reapplied by producers to less demanding applications, because of concerns related to surface imperfections. While problems arising during painting at the vehicle assembly plant are increasingly rare due to improved processes and quality assurance procedures in the steel industry, they can be of great inconvenience and concern when they do occur. This project was initiated to develop a methodology to better quantify the geometry of surface imperfections and to understand their evolution during forming and painting. The ability to quantitatively assess the severity of specific surface features is expected to lead to more objective inspection and acceptance criteria. Better coil-disposition decisions should thus be possible, resulting in improved quality and delivery as well as cost savings via higher application rates. Furthermore, quantitative understanding of the behavior of different surface features should allow future quality improvement efforts to focus on the highest priority issues.

Surface Topography of Steel Sheets



The image is a contour plot showing the surface topography of a galvanneal-coated sheet steel after straining 10 percent. The dark feature represents a microcrack from a small region of the coating surface. The vertical scale is indicated in the adjacent color scale.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

Project Description

Goal: To develop a methodology to better quantify the geometry of surface imperfections and to understand their evolution during forming and painting.

Surface quality of exposed sheet steels represents an enormous economic, technical, and operating issue for steel producers, and for steel users such as the automobile manufacturers. The research consists of creating and sampling imperfections on (initially) galvannealed surfaces, and carefully characterizing the topography. Changes in the surface are to be measured after forming and painting simulations, and visibility after painting is to be assessed in conjunction with automotive experts. The results will be analyzed to understand the changes which occur during painting and forming, and to determine whether it may be appropriate to consider quantitative inspection criteria.

Progress and Milestones

- Project start date, March 1999.

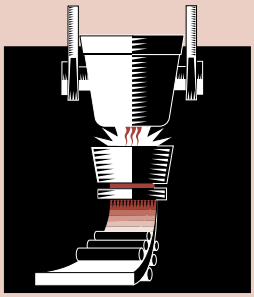
- In the first six-month preproject phase from March through September 1999, the following milestones were achieved:
  - Project partners met and agreed upon the objectives and work plans.
  - Additional participants were contacted from the paint supplier and automotive assembly community, and are supporting the project. Experimental painting procedures were established.
  - A three-dimensional (3-D) optical profiler was purchased and installed. Two students began their studies, making preliminary surface measurements, and creating controlled surface features in the laboratory.

- In the project phase of the work from October 1999 through December 2000, the following milestones were achieved:

  - Numerous laboratory surface imperfections were imparted to four steel surfaces (uncoated, and with three different metallic coatings). The imperfection topogra phies were measured, and the samples were subjected to numerous steps simulating the automotive painting process. After painting, the samples were evaluated visually while using the 3-D profiler at each step. Preliminary analysis of the data has been completed and presented to project participants. A methodology to assess painting response has been demonstrated.
  - Forming studies have also bee conducted, and tooling has been machined to impart simulated forming strains to sheet surfaces. Preliminary measurements on samples with and without laboratory-induced imperfections have been completed, and chages in the surface features have been reported.
  - Preliminary painting experiments have been completed on industrial samples containing selected imperfections. The results have shown that some features disappear after painting, while others remain visible. Characteristics of the features of interest have been presented to project participants.

- In the remaining phase of the work from January through September 2001, the following milestones are planned:

  - Experimental work on forming response of laboratory-induced imperfections will be complete. Analysis of forming and painting of laboratory samples will be completed and documented.
  - Sampling of selected industrial imperfection surfaces will be completed, and focussed forming and painting evaluations will be conducted and analyzed.
  - A project meeting will be held in the Summer of 2001 to review the implications and discuss further implementation.



Project Partners

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